

Discovery of the Sub-second Linearly Polarized Spikes of Synchrotron Origin in the UV Ceti Giant Optical Flare

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Abstract

Copyright © Astronomical Society of Australia 2017 During our optical monitoring of UV Ceti, iconic late-type flaring star, with high temporal resolution using the Russian 6-m telescope in 2008, we detected a giant flare with the amplitude of about 3 magnitudes in U band. Near flare maximum, more than a dozen of spike bursts have been discovered with triangular shapes and durations from 0.6 to 1.2 s and maximal luminosities in the range $(1.5-8) \times 10^{27} \text{ erg s}^{-1}$. For the half of these events, the linear polarization exceeds 35% with significance better than 5σ . We argue that these events are synchrotron emission of electron streams with the energies of several hundred MeV moving in the magnetic field of about 1.4 kG. Emission from such ultra-relativistic (with energies far exceeding 10 MeV) particles is being routinely observed in solar flares, but has never been detected from UV Ceti-type stars. This is the first ever detection of linearly polarized optical light from the UV Ceti-type stars which indicates that at least some fraction of the flaring events on these stars is powered by a non-thermal synchrotron emission mechanism.

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Keywords

polarization – radiation mechanisms: non-thermal – stars: flare – stars: individual (UV Ceti)